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NON-DEVELOPMENTAL ITEMS (NDI) POLICY:
THE EFFECT ON HM&E STANDARDIZATION

by

Richard Bruce McKenna

June 1988

Thesis Advisor: Paul M. Carrick

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Non-developmental Items (NDI) Policy: The Effect on HM&E Standardization

by

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Submitted in partial fulfillment of the
requirements for the degree of

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I. INTRODUCTION

A. FOCUS OF THE STUDY

An Allowance Parts List (APL) is an identification number and parts support data package that is assigned to all equipment and components which are significantly different than other equipment performing the same or different functions, are mission essential, or require onboard part support. Over the past ten years the introduction of new APL's to the fleet has averaged 8,778 per year in Hull, Maintenance, and Electrical (HM&E) equipment alone. [Ref. 1] This influx of new APL's accounts for millions of dollars in additional administrative costs each year. The annual increase in APL's corresponds to an average increase in part support/new National Stock Numbers of 28,559 [Ref. 1] per year. The costs of procuring and replenishing the additional depth of the repair/support parts or more importantly the additional range of the new National Stock Numbers (NSN's) for these new APL's has not been determined but is unquestionably high. The numbers appear to indicate that standardization of Navy HM&E equipment is out of control and that excessive proliferation of parts, components, and equipments exist.

This thesis will discuss three factors that can significantly contribute to a proliferation problem:

1. Congressional legislation calling for "preference for nondevelopment items."

2. HM&E standardization efforts currently being studied and implemented at the Navy Ships Parts Control Center and the Naval Sea Logistic Center.

3. The efforts and abilities of voluntary non-government standardization groups to implement Navy requirements within its specifications and develop standards for HM&E recognized and utilized within industry.

In 1986 Congress included in its defense appropriations bill a proviso that the defense department must consider what is available in the commercial market--"off the shelf" items--prior to contracting for any item or beginning the research, development and testing phases that accompany the development of purchase specifications for a new item purchase. The official designation for these "off the shelf" items is Non-developmental Items (NDI). NDI's are referred to as already developed and available hardware or software that are capable of fulfilling technical requirements. Reliance on NDI will presumably minimize or eliminate the need for costly, time consuming government-sponsored research and development programs [Ref. 2] and specification preparation investment.

The Department of Defense (DoD) and the Navy in particular have been working to determine the effects of implementing an NDI policy on the operational capabilities within the fleet and the HM&E standardization programs. By opening up procurement practices for HM&E equipments and accepting items that do not conform to military design and

performance standards and specifications, the Navy may be exasperating the APL proliferation problem. Also, buying NDI material in lieu of an item designed to military specifications may lead to a stock of materials that will not survive in a warship environment.

B. OBJECTIVES

This thesis investigates: 1) The effect of NDI legislation on the efforts to curb APL proliferation in the purchases of HM&E related items, and 2) Whether or not voluntary non-government standards and boards are an effective force with the ability to incorporate the Navy's specific needs and requirements into industry standards. The presentation of these questions will be only preliminary because of the complexity of the matter. The relatedness of the two objectives will be discussed later in the paper.

C. RESEARCH QUESTIONS

In order to accomplish the above objectives, the primary research question addressed in this paper is: Can non-government standards be developed sufficiently, rapidly, and responsively and used to:

- effectively replace government standards and thereby serve as a prerequisite for determining whether or not an item is an acceptable NDI acquisition?
- curb APL and spare parts range proliferation in a more effective manner than the standardization programs currently being tested and developed?

In accomplishing the above the thesis will also answer in part what items or data need to be considered in determining whether an NDI item should be purchased by performance specification as opposed to developing in-house military/government specifications to guide the acquisition process?

The subsidiary questions that are used to aid in determining the answer to the above questions are:

1. What is the origin of NDI legislation, its expected benefits, and anticipated problems?
2. How do the DOD and the Navy define NDI policy as opposed to past procurement policy?
3. To what extent does APL and stock proliferation among HM&E material result in added costs?
4. What effect will the NDI policy have on the problems of APL proliferation?
5. Are effective standardization efforts currently being implemented to address the APL proliferation problem?
6. What determines whether the Navy will adopt a non-government standard?
7. What inputs do the non-government standards boards use, how often do they meet, and who determines their agenda?
8. Can the main determinant used to determine the acceptability/adaptability of an NDI item be voluntary non-government standards and board actions?

D. RESEARCH METHODOLOGY

Research was conducted by intensively reviewing publications, reports, papers, instructions, memorandums, and letters that were originated within the DOD and the

Navy. Outside literature was reviewed and numerous interviews were conducted in person and over the telephone.

E. SCOPE OF THE STUDY

This study is limited to HM&E equipment/material managed by the Navy's Ships Parts Control Center (SPCC). It is necessary to restrict the study to a group of items that have like characteristics in order to avoid excessively broad generalizations. HM&E material is generally stable and is typically not subject to sweeping changes in technological development. Also, HM&E experiences the same general Integrated Logistics Support (ILS) problems that arise with ship installed equipment. If the equipment were not intended for shipboard use other avenues of ILS support could be pursued that would preclude a need for a supporting spare parts inventory. A representative list of the 89 general types of equipment or commodity classes that comprise the HM&E material is included in Chapter IV.

F. LIMITATIONS

This thesis examines NDI solely as it relates to HM&E. The conclusions it draws are not necessarily transferable to different types or classes of material. Different Inventory Control Points (ICP's) have been established to manage the requisitioning and provisioning of the variety of items purchased by the DOD and the Navy.

Secondly, the study will investigate the effectiveness of non-government standards groups based on a review of only one group: the Shipbuilding Committee, designated F-25, of the American Society of Testing Materials (ASTM). Several hundred standardization bodies exist. The ASTM committee was selected as a representative of the population because a strong relationship already exists between the Navy and the F-25 committee. There is at least one representative from the Naval Sea Systems Command (NAVSEASYSCOM) serving as a member for each of the F-25 subcommittees. The conclusions drawn as to the effectiveness of voluntary standards bodies, though drawn from an optimal but maybe less than representative source, can only be a preliminary assessment of the entire spectrum of voluntary organizations' effectiveness in fulfilling DOD requirements.

G. ASSUMPTIONS

It is assumed throughout this thesis that the reader is familiar with basic Navy terminology especially as it pertains to SPCC and the Naval Sea Logistics Center (NAVSEALOGCEN). Furthermore, it is assumed that the reader is familiar with the basic policies involved in federal government procurement procedures.

H. ORGANIZATION

This thesis is divided into six chapters. Chapter I is the introduction. Chapter II discusses research question 1,

the origin of NDI and DoD/Navy's policy effecting its implementation, and the possible impact on APL proliferation. Chapter III discusses the DoD/Navy philosophy in interpreting and implementing NDI legislation. Chapter IV examines APL and stock proliferation and the effects NDI policy action could have on the problem. Chapter V describes non-government voluntary standards groups and evaluates their effectiveness to date in reflecting the Navy's requirements. It will also discuss the present and future feasibility of using their output as a determinant to whether or not a product is an acceptable NDI candidate. A summary of the results of the first five chapters and resulting recommendations are included as Chapter VI.

II. NON-DEVELOPMENTAL ITEMS

A. INTRODUCTION

In 1986 the emphasis on acquisition sources and procedures within the DOD was changed with enactment of the fiscal year 1987 Defense Authorization Act by Congress. Section 907 of this act amends Chapter 137 of title 10 of the United States Code to include a "preference for nondevelopmental items." Two reports precipitated the congressional action. The President's Blue Ribbon Commission on Defense Management (The Packard Commission) and the Defense Science Board Task Force 1986 Summer Study submitted reports to congress that significantly shaped the congressional action.

B. BACKGROUND

The country's political and economic policy as it relates to NDI is not new. Over the past 25 years it has been the government's philosophy to rely on the private sector, where practical and feasible, to meet its needs. [Ref. 3:p. 2] Adoption of non-government standards, which is in effect an NDI policy, started in 1962 when 12 documents were brought into the DoD system. [Ref. 4:p. 1] In 1972 the Commission on Government Procurement reemphasized the need for a shift in fundamental philosophy toward commercial product acquisition. [Ref. 2:p. 1-1] The

rational for such was wholly economic. This approach would allow the government to avoid the high costs associated with product development, avoid specification development costs, and save on ILS costs by utilizing established commercial distribution channels to support the product. [Ref. 2:p. 1-1] In 1974 the Office of Federal Procurement Policy was founded. Their charter required that they foster a reliance on the private sector. In 1976 The Office of Federal Procurement Policy adopted all the Commission's recommendations and issued a series of memorandums governing the procurement of commercial products.

In 1982 the government recognized that a policy needed to be reinstituted toward federal government reliance on non-government standards. The Office of Management and Budget (OMB) Circular A-119, Federal Participation in the Development and Use of Voluntary Standards, established new standards policy for Federal agency interaction with non-government standards bodies and for government use of their standards. A-119 advocates that voluntary private standards and standards development activities are to be used, promoted, and, adopted wherever possible in lieu of government standards. [Ref. 5:p. 14] A-119 also directed that:

- Government standards be reviewed every five years.
- An agency seek non-government standards which can be substituted for any existing or new government standard.

- Only when existing voluntary standards are found to be inadequate, unacceptable, or not forthcoming can the government fall back on its own standards and standards writing committees.

The practicality of such an absolute course of action and the extent to which DoD/Navy has been able to live up to the intent of this directive and the subsequent NDI legislation is another topic that will be discussed later in the thesis. By 1986, DoD had formally adopted over 3,500 non-government standards and were utilizing many more as references in military specifications and standards. [Ref. 6:p. 21] Non-government standards comprised 7.68% of the total of 46,728 specifications and standards within DoD, 15,756 of which were prepared for the Navy. [Ref. 6:Figure 4]

Furthermore, as early as 1980 the Naval Sea Systems Command had designated a focal point for non-government standards bodies liaison, NAVSEA Code 55Z for all HM&E equipment, whose job included initiating or directing NAVSEA participation in developing non-government standards, converting Navy documents to non-government standards, and adopting satisfactory non-government standards for use by DoD. [Ref. 7:p. 3]

C. THE PACKARD COMMISSION

In 1986, the President's Blue Ribbon Commission on Defense Management concluded its study on defense management practices and submitted its report re-emphasizing the

recommendations of earlier studies. The Packard Commission report specifically recommended:

> Rather than relying an excessively rigid military specifications, the DoD should make greater use of components, systems, and services available "off the shelf." It should develop new or custom made items only when it has been established that those readily available items are clearly inadequate to meet military requirements.

The Packard Commission also noted that the Defense System Acquisition Review Council had not been successful in stimulating the use of NDI as an alternative to the continued use of military specifications or the development of unique military products.

It is also important to note that both the Packard Commission and the 1986 Defense Science Board in a follow-on study titled, "The Use of Commercial Components in Military Equipment," determined that criteria other than product price had to be considered before determining whether to buy NDI, thereby supporting the tenets of OMB Circular A-109. Life cycle costs should be used in a contract award decision and items such as item supportability, maintainability, interoperability, reliability, warranty, training, and reprocurement must be considered. However in none of these documents did it say how to assign costs to these items in order to conduct a cost benefit analysis of one product or procurement method over another.

D. NATIONAL DEFENSE AUTHORIZATION ACT OF 1987

Based on the above recommendations Congress made it public law in section 907 of the above act that:

The Secretary of Defense shall ensure that to the maximum extent practicable--

- requirements of the DoD with respect to the procurement of supplies are stated in terms of:
  - functions to be performed
  - performance required
  - essential physical characteristics
- such requirements are defined so that nondevelopmental items may be procured to fulfill such requirements; and
- such requirements are fulfilled through the procurement of nondevelopmental items. [Ref. 8]

The law also officially defined NDI as:

1. Any item of supply that is available in the commercial marketplace.
2. Any previously developed item of supply that is in use by a department or agency of the United States, a State or local government, or a foreign government with which the united states has a mutual defense cooperation agreement.
3. Any item of supply described above that requires only minor modification in order to meet the requirements of the procuring agency.
4. Any item of supply that is currently being produced that does not meet the above requirements solely because the item is: (1) not yet in use or, (2) not yet available in the commercial marketplace.

The law also tasked DoD to enforce this legislation on the services, as well as to identify and remove where possible any statutes and legislation that may impede the effectiveness of this initiative. DoD is to report on the

progress of implementing all the above requirements before the first anniversary of the enactment of this act.

E. SUMMARY

The 1987 Defense Authorization Act changes the premises upon which initial and provisioning procurements are to be made. It was precipitated by the Packard Commission Report and that Commission's perception that despite the emphasis that has been reported in the background section of this chapter regarding DoD's utilization of non-government standards, little advance had been made in this area. Whether or not there was an unseen bias in this report is not the subject of this paper. In a literal interpretation, the new law requires every purchase to be extensively evaluated to first determine if an "off the shelf" item exists or if a commercial item exists that requires only moderate modification to meet the governments needs.

This is, if interpreted in the strictest manner, a short run money saving endeavor that could possibly induce occurrence of downstream life-cycle (ILS) costs that far exceed the projected initial procurement cost savings. As will be seen in later chapters an effective method of assigning values to determine the cost-effectiveness of using an NDI item in an HM&E environment is highly complicated with ill defined boundaries as to which direct and indirect costs should be quantified and used in determining the suitability of an NDI acquisition.

III. NDI POLICY

A. INTRODUCTION

The Logistic Systems Analysis Office (LSAO) completed and published a study in 1987 entitled Implications of NonDevelopmental Item Systems Acquisitions for DoD Logistics Support. The Office of the Specification Control Advocate of the Navy has prepared an NDI handbook draft entitled Department of the Navy Handbook of Non-Developmental Item Acquisitions. DoD has drafted Directive 5000.37, Acquisition and Logistic Support of Nondevelopmental Items (NDI). These three publications form the basis on which the Navy will interpret and incorporate NDI as an alternative acquisition tool. The first publication is a definitive guide to the potential hazards and benefits of NDI compiled from input from all the services. The second publication, the Navy NDI Handbook, is primarily a "how to" guidebook. The third publication was issued in order to implement the Congressional Act and establish policies and responsibilities for the acquisition of NDI within DoD.

This chapter is a summary of the contents of these three publications. It is meant to give an insight into their strong points while uncovering the points that need more clarification. Many agencies interviewed for this report including many individuals at SPCC and NAVSEA did not

anticipate any implications of NDI beyond high technology large ticket items. However, NDI policies apply to the requirements for all end items, weapons, equipment, components, or material for which commercial or other off-the-shelf products are used or can be used. [Ref. 9:p. 2]

B. BACKGROUND

The concept of utilizing NDI for DoD purchases did not magically come into being with the passage of the 1987 Defense Acquisition Act. The AT&T Dimension 2000 telephone system and the Zenith 120 and 248 Personal Computers are examples of NDI that were in the fleet prior to the authorization act. Configuration control, provisioning technical data, budgeting data and planned usage are and were unknowns in these purchases. The support and success of these systems has been limited and inconsistent. [Ref. 10] The Dimension 2000 phone system, which has been installed on ships as recently as 1986[1], is soon to go out of production. This will possibly result in massive ILS costs and early system obsolescence.

The Zenith 120 Microcomputer is another example of an NDI purchase that was successful at providing needed material to the fleet in a timely manner; yet a failure at meeting sustainability and support requirements. [Ref. 10] The Zenith 120 was procured to satisfy an immediate fleet

---

[1]The AT&T dimension 2000 phone system was installed on the USS Charles F. Adams during its 1985-1986 overhaul.

requirement for microcomputer capability while awaiting deployment of a traditionally procured ADP system. Zenith was awarded the initial contract in October 1983. The intent was to support these systems fully with commercial contractor services. This did not work. By 1985, the fleet population of Zenith 120's was estimated to be 3000 units. In October 1985 a contract for 20 Zenith 120 spare parts was awarded by SPCC. As of September 2, 1986 there was no Hardware System Command sponsor to determine additional parts support requirements for the Zenith 120.

Other initiatives toward the NDI premise are ongoing and successful programs. The "Buy Our Spares Smart" program is an example of a program that as one of its objectives has sought to identify alternative sources of supply, a form of off-the-shelf items in lieu of higher priced stock numbered items. Technicians and users in the fleet are encouraged to identify items with NSN's that appear to be overpriced and identify new less expensive sources of procurement. A three year summary of pricing challenges, source savings, and results are presented in the following table. The table records the total number of challenges called in to the hot line for the last three fiscal years, the number of challenges that were recommendations for new cheaper sources of supply, the number of alternate sources of supply that were determined to be valid less expensive sources of supply, and the projected procurement cost savings that

would result from the added lower priced competition. Projected savings are calculated by taking estimated annual usage and multiplying it by the difference between the old NSN price and the new source price. The totals do not add up because they include data from fiscal years prior to FY 1985.

FISCAL YEAR	TOTAL CHALLENGES	SOURCE CHALLENGES	SOURCE ACCEPTANCES	PROJ. SAVINGS
1985	7520	656	60	$1.3M
1986	8463	1154	102	8.4M
1987	10006	1187	138	2.6M
TOTALS	33640	3744	384	$13.6M

[Ref. 11]

As of the date of acquisition of this data this is the correct number of source acceptances and dollar savings for fiscal year 1987. It is anticipated that both values will increase as further research and determinations are made.

C. ADVANTAGES

The advantages that are derived from using NDI described in this section are applicable dependent mainly upon the extent to which an item is purely NDI. Prior to the statutory definition of NDI and the DoD interpretation listed above, each service had their own definition. The Army, which has developed the greatest amount of policy regarding NDI, classifies NDI into three categories. The

categories are distinguished by the type of additional development an item requires and are:

> Category A--Off-the-shelf items to be used in the same environment for which the items were designed with little or no further development required.
>
> Category B--Off-the-shelf items to be used in an environment different than that for which the items were designed with some development required (ruggedization).
>
> Category C--Integration of existing componentry and the essential engineering effort to accomplish systems integration with research and development to integrate systems.

It can be seen that as one moves away from "pure" NDI, Category A, to items that incorporate military standards and specifications the advantages discussed below will diminish.

The primary advantages of NDI acquisition are the time and cost savings that can be generated. NDI allows the military to:

- Reduce its reliance on its own rigidly developed specications and standards and provide a quick response to operational needs by qualifying an item for use based on proven commercial performance. (An item's conformance to approved non-government standards is a possible basis for evaluating commercial performance.)
- Reduce administrative and production lead times while attaining a faster procurement schedule by virtually eliminating new product research and development time and buying a product that is already through or in production.
- Purchase, in some instances, state of the art technology with a reduction in technical, cost, and schedule risks.

D. DISADVANTAGES TO NDI

The disadvantages to NDI are more commonly referred to as "challenges" in DoD literature. Many of the challenges

are directed at the concept of NDI in general but have more to do with the increased emphasis that is being afforded it. NDI will not result in the provisioning department at SPCC operating any differently than it has in the past unless the rules that determine an item's military acceptability are drastically changed. [Ref. 12] Historically, contract bids have allowed a contractor to match his inventory and production capabilities against a government requirement. Awards could then be made to the lowest bidder with a modicum of assurance that the lowest bidder would meet a set of minimum quality and performance standards.

The disadvantages that may develop are discussed in detail in the LSAO report and are directly related to the issues of timing, support concept, current forces interacting with NDI, standardization, and configuration management. This paper is most concerned with the topic of standardization as it relates to equipment supportability, APL proliferation, and ILS costs. In this respect pure NDI purchases occurring in field contracting offices below the Inventory Control Point or Hardware System Command's purview has very negative effects.

Commercial items have an average life span of three to five years on Military Sealift Command ships [Ref. 13] compared to an expected design life span of ten to 20 years for the military component counterpart. Military designed systems normally have four major phases in their acquisition

cycle. Provisioning and technical data decisions and orders are normally made during the production phase. An NDI acquisition speeds up the process such that delivery can occur before determinations are made regarding manning, training, and test equipment requirements. Also, APL's and spare parts support packages do not get developed and technical manuals and drawings may not be available. The average administrative lead time for SPCC to reprovision items that are already in stock is 17 months. [Ref. 14] In short, barring contractor support as in the case of the Zenith 120 computer, NDI items can be delivered, break, become unrepairable, or become obsolete before an APL is developed or the first delivery of spare parts arrive onboard a fleet unit. Also, leading to the accelerated obsolescence of the NDI item is the problems that develop because the accelerated purchase procedures allow no time for development of Preventative Maintenance Schedules (PMS), technician training, and distribution of technical manuals and documents.

Relatedly, the Commander Naval Forces Pacific (COMNAVSURFPAC) made the following observations regarding non-SHIPALT electronic/weapon systems installations (NDI):

> Rapid advances in electronics/computer technology and support software have outstripped our ability to procure them through the existing acquisition in a timely fashion. Ship acquisition is pushing nine years and equipment/ system acquisition is approaching twelve years. At the current rate of technology advancement, equipment/systems procured "within the system" could be one to three years behind state of the art....NDI, Fleet Initiatives and

Rapid Prototype programs have all surfaced to help bridge this time lag.

With the acquisition of desk top computers and off-the-shelf hardware, we are buying into maintenance strategies which minimize organizational involvement and rely on redundancy. Prototyping is being used to outfit entire battle groups rather than validating a concept on a small scale. The requirements of the acquisition logistician are time consuming, tedious, cumbersome, etc,. However unless NDI initiatives account for the "ilities" (maintainability, supportability, reliability, etc.), any gains in acquisition time will likely be negated by our inability to maintain these items at sea, away from our home bases. [Ref. 15]

E. IMPLICATIONS

Current directives in force regarding NDI do not differentiate between the ILS support needs of a ship versus a shore based squadron or command. The implications are clear. An overall Navy policy toward NDI is not desirable. In fact it could encourage policy that leads to further non-standardization in the fleet and exasperate many of the concerns previously mentioned. As will be discussed in the next chapter more fully, any policy directed toward HM&E that is not adjusted to carefully consider and weight the effect on fleet standardization is not economical. The Navy handbook on NDI, even though allowing for all kinds of tradeoff analysis to take place before making a contract award decision, does not do enough to task inventory managers to develop cost effectiveness studies of their own.

For example, in the case of HM&E, an item manager must decide certain major items:

- Is the item high value or throw away?
- Is the item essential to a ship performing any of its primary missions?
- Is the item APL worthy?

If the item is not any of the above than an NDI decision is not materially different from any past procurement decision. However, if the item falls into one of the above categories then a provisioning group must consider which of the four types of support is required for the item. The four types of support are:

1. Discard system and equipment upon failure (no support).
2. Total contractor support.
3. Organic support.
4. A combination of organic and contractor support.

Type two and, to a lesser extent, type four support are not practical for a mission essential shipboard piece of equipment unless separate wartime and peacetime concepts of support and repair are developed. While such innovative concepts may appear very attractive to the shore-based logistician and comptroller, they would not meet the requirements of a fleet commander. Few individuals can accurately predict the onslaught of hostilities.

The enormous number of variables, therefore, excludes anyone from making a standard equation that could determine whether an NDI purchase was better than a non-NDI even for the limited area of HM&E. To aid the procurement process, a

revised policy on specification and standards control has resulted in cognizant engineers updating all standards over five years old and any standards or specifications that are over six years old cannot be used in first time procurements after 1 October, 1988. [Ref. 16] The review of all specifications and standards at NAVSEA has been completed. [Ref. 17] It can therefore be made incumbent on industry to prove its products acceptability to these reviewed standards. If voluntary non-government standards groups are effective and responsive to DoD's requirements then the avenue exists to streamline this decision process, which is the topic of the last chapter of this thesis. However, if non-government standards are unresponsive to the DoD environment or non-existent then the decision to use or not use NDI can be very difficult. Also, the lack of a set determination method result in completely opposite determinations dependent upon who is making the decision, what they want the decision to be, and what variables and weights are employed.

F. CONCLUSION

The positive aspects of the new NDI emphasis is that it surely played a major role in the priority given to update Navy procurement specifications and standards. It has made it faster and easier to procure state of the art technology when acceptable commercial items exist. It has also resulted in organizations scrutinizing past NDI decisions

and evaluating the results. The lessons learned from these examples need to be correlated and distributed to Navy procurers as well as industry buyers.

Some of the most "challenging" aspects of NDI will be to recognize which life-cycle costs should be used to determine the efficiency and cost effectiveness of an NDI acquisition candidate. Recording the decision process must be carefully done so as to preclude the possibility of a commercial firm challenging a contract award decision, thereby further lengthening the acquisition's lead time.

Inventory Managers must take the broad Navy guidance written in the Navy's NDI Handbook and tailor it to the different requirements inherent in the types of equipment for which they are responsible. Large quantity system buys below the Inventory Manager's level have been made by people not aware of the implications. This has resulted in non-support and early obsolescence. The authority for large commands to make these decisions should be reviewed. A special review should be given to the policies regarding small one time NDI buys that are designed to meet contingency requirements. These NDI purchases result in the same non-support conditions that have been discussed at a larger level and often are a result of a command placing wartime priorities on peacetime requirements.

G. SUMMARY

In order to best make the decision to NDI or not NDI one must be familiar with all that is discussed above. Also one must be familiar with the threat that an unbridled NDI policy could have on the management and use of NDI equipment. A poorly managed NDI policy would adversely effect standardization efforts in the fleet due to both the shorter projected NDI lifespan and the propensity for commercial firms to change their design. [Ref. 3:p. 5] The extent of that problem is the topic of the next chapter.

The other major question in the NDI procurement decision process is how to determine product acceptability. The revision of all standards and specification is a major step in that direction but the different sizes, shapes, and maintenance and training requirements can generate enormous installation costs. Therefore if item requirements are going to be "defined so that non developmental items may be procured," shortcut methods must be used to determine a commercial items acceptability. Chapter V discusses the possibility of using and developing non-government voluntary group's standards to accomplish this end while reducing purchase price, ensuring item acceptability, and promoting standardization and its benefits.

IV. PROLIFERATION AND NON-STANDARDIZATION

A. INTRODUCTION

NAVSEALOGCEN has created numerous standardization data bases, files, and reports from which much of the data presented in this chapter is extracted. Readily apparent from just a cursory review of the historical data is the proliferation rate of HM&E APL's. As stated in Chapter I, there has been an average annual net increase over the past ten years of 8,778 new APL's and 28,559 new NSN's. The associated additional ILS costs for these increases is estimated at $111.5M per year. Further evidence of the magnitude of the problem can be derived from the following statistics:

- There are over 188,000 HM&E equipments with different APL's installed on active duty ships.
- Over 73.36% are used on five or less ships.
- 34.61% or 65,403 APL's are unique to only one ship.
- Over 34,000 HM&E APL worthy equipments appear only once in any application in the fleet. [Ref. 18:p. V]

Some APL growth is highly desirable and acceptable. New products and technology can lead to increased performance and ship capability. Unfortunately, much of the above growth appears to be linked to manufacturers or model differences that result from using performance

standards/specifications vice design or build to specifications.

Non-standardization results in increased inventory range requirements and life cycle/ownership costs. It would also appear to be a function of the contracting officer ignoring Ownership Costs by placing all emphasis as to whether or not to award a contract on the basis of which bidder submits the proposal with the lowest acquisition price. There are detailed regulations written for the procedures that must be followed when a project manager is coordinating the acquisition plan for a new major weapon system regarding the computation of ownership costs. The reprovisioning of HM&E equipment, components, and parts at SPCC is triggered by relatively complex computer generated inventory and EOQ models. It can be assumed that because the EOQ model is designed to minimize costs the reordering for any one item is held to a minimum. The dollar amounts associated with many of the contracts are relatively small in size. Until recently ownership costs were deemed insignificant compared to the benefits perceived from increasing competition and the industrial base.

Without the standardization data bases compiled only in the last few years by NAVSEALOGCEN, it was hard to understand how anyone could even assess the true magnitude of the proliferation problem and the resulting increase in ownership costs that accompanied it. Utilizing the

information that has been stated in previous chapters, it can be inferred based on both intuitive and factual data that increased NDI procurement activity increases the level of equipment non-standardization. NDI is the purchase of off the shelf equipment including those items that may require minor modification to meet military standards. Essentially that definition covers a major percentage of all the reprovisioning equipment purchased by SPCC. Valves, pumps, engines, and motors are universally available in all different sizes and shapes. Whether or not non-government standards exist or can be developed to create standards within the industry for any of these items is a topic of a later chapter. But let us assume that the Navy's usage while substantial is in most cases an insignificant portion of the market share. Clarke's study on diesel engines [Ref. 19] and Tryon's thesis on integrated circuits [Ref. 20] support this assumption.

NDI would appear to be little more than a term defining current purchasing procedures at SPCC. The major effects of the legislation will be in how it is interpreted by contracting agents outside of SPCC when they are procuring equipment that will later be supported by SPCC. The lessons to be learned can be drawn from the thousands of NDI/reprovisioning decisions that have resulted in the growth of non-standardization in HM&E.

In order to determine the effects of NDI as it relates to the increased non-standardization of HM&E to date, this chapter will discuss:

- The criteria used in deciding whether to assign a new APL and the costs that decision carries with it.
- The magnitude of the APL proliferation problem.
- The costs of competition for NDI HM&E and the associated equipment parts and range build up.
- The potential causes and sources of the new APL's.
- Two standardization programs designed to limit APL proliferation.

B. APL WORTHINESS

References have been made regarding APL's throughout this thesis. Thus far little definition has been given as to what constitutes the need for an APL number and what criteria shall be used in making the decision as to whether or not an APL should be assigned to a new piece of equipment. For the equipments that SPCC is the program support ICP, APL's are concurrently assigned with and based upon the Allowance Support Code (ASC) that is assigned to the equipment. [Ref. 21:p. 1] ASC is the collective title given to three separate but related codes that record information concerning an equipment or component. The three codes the ASC is comprised of are:

- The Technical Cognizance Code, assigned by SPCC when a new equipment is identified or procured, identifies the Hardware Systems Command having technical control over the equipment or component.

- The Application/Identification Number Activity Code, assigned by SPCC, records the ICP responsible for program support for the equipment and the type of configuration number assigned.

- The Logistic Support Status Code records the decision of the Hardware Systems Command as to the degree of support required and the extent or type of support currently available for the equipment or component, or the reason an equipment may not be supported by allowances or through the supply system. [Ref. 21:p. 3]

Therefore SPCC assigns an APL to:

- Equipments and components for which full or partial supply support is provided.

- Equipments or components for which no specific supply support is provided when record of the equipment or component application is required for configuration accounting purposes.

In short equipments that are deemed mission essential and that require repair part support or equipments that are significantly different from other functionally equal equipments so as to require increased or different personal training, maintenance equipment or maintenance procedures are issued their own APL's. An ILS determination normally to happens before end product procurement and delivery so that a timely provisioning process can take place. That is not always the case. Requisitions for emergency or system requirements contracted at other than the ICP level are recorded through a maintenance reporting system that is slow to interface with the provisioning process. Additional guidelines including over 20 pages of special instructions pertinent to APL preparation or non-preparation are included

as enclosure (2) to attachment (1) of NAVSEA Instruction 4441.4.

C. APL COSTS

The mere addition of a new APL is a costly endeavor. Each new APL requires certain administrative costs in order to generate the document and maintain it. The real costs of a new APL while available and quantified in the NAVSEALOGCEN Standardization Benefits Analysis Report by commodity class is best computed individually. The hidden costs associated with introducing a new piece of equipment/APL to the fleet is better described by an evaluation similar to the 'summary of costs associated with competitive procurements' [Ref. 22]. The cost of competition or of an award made to a company that would provide a product significantly different from what is currently in the inventory system so as to warrant its own APL is the same as the ownership costs that can be attributed to an NDI purchase. It is represented by the following equation:

$$C = Cptd + Cp + Cm + Ct + Ctm + Cd + Ccc + Cqt + Cpm$$

where:

C = Cost of Competition

Cptd = Cost of Provisioning Technical Documentation

Cm = Cost of Provisioning

Cm = Cost of Maintenance

Ct = Cost of Training

Ctm = Cost of Technical Manuals

Cd = Cost of Installation Drawing Changes

Ccc = Cost of Configuration Control

Cqt = Cost of Testing

Cpm = Cost of Planned Maintenance.

For HM&E equipment this evaluation can be converted to incorporate the number of parts stocked for the equipment being replaced (P), the expected life cycle of the new equipment (L), the price of the original equipment (PR), the number of classes of ships receiving the equipment (CL), and the total number of equipments to be installed (POP). The resulting equation that is used by NAVSEALOGCEN is a useful tool in estimating the costs that the government will incur by awarding a contract that will result in an alternate design/APL support package. The cost value is as previously stated the ownership cost and is separate and apart from a contract award price. While some of the values can be equal to zero it is not probable that the cost of competition equals zero.

Despite the additional costs of adding new APL's to the Fleet, there has been a relatively constant increase of about 9,000 a year. A competition advocate would argue that the added benefits of competitive bidding such as increasing the industrial base, increased technological development, and an ultimately a less expensive end product because more

than one company is capable of producing the product are worth more than the additional costs implied by the cost of competition equation. While that may be true in some instances, it has not been an apparent factor in contract award determinations to date.

While performing the research for this thesis, no evidence has been discovered to indicate that any procurement or acquisition instruction exists that defines what costs and benefits should be considered prior to contract award, how values should be arrived at and assigned, nor what criteria should be used to determine when the cost of proliferation exceeds the benefits of standardization. The intent that such procedures should be heavily weighted prior to any award is omnipresent.

While this equation serves to place a nominal value on the cost of adding an additional APL the values are purely subjective. Each one of the variables assigned to the equation is composed of multiple sub-variables that require subjective value judgments to be made. For example, the cost of training can be effected by the length of training required, training site costs, etc. The number of factors is arbitrary and can easily be offset by an imaginative interpretation of the anticipated benefits. While the use of this equation is not a requirement of any SPCC or NAVSEA instruction, it is an integral part of a standardization

program that is being readied for implementation and will be discussed later in the chapter.

D. PROLIFERATION/NON-STANDARDIZATION

The proliferation of HM&E APL's does not always correlate favorably with increased capabilities but instead can result in one function being performed by many different pieces of equipment.

A functionally interchangeable, but different design valve was recently procured by the USS Miller (FF-1091) from the supply system. The replacement valve weighed 400 pounds more than the original valve that it was replacing and required significant piping configuration changes at considerable cost in order to effect installation. Similarly the number of functionally similar equipments that are significantly different enough to require separate APL's.

Research was recently completed that determined that the Navy supported more than twenty different small boat engine equipment APL's representing a ship population of 430 and a fleet population of 878 which were functionally interchangeable based on six critical form, fit, and function characteristics. [Ref. 19:p. 37] In this instance all 20 APL engines were produced by the same company, Detroit Diesel. Acquisition specifications did not change; only the technology employed in the engine. Despite a high degree of repair part interchangeability, the administrative

costs of building and maintaining new APL's and necessary maintenance data are real. Clark concluded in his publication that the Navy has allowed commercial market forces to solve its ownership cost minimization problem. However, Clark's choice of an equipment to analyze would not seem to yield results indicative of all similar equipment groups that could have been used. Clark was unable to determine why Detroit Diesel was the only manufacturer of this type Navy diesel. A more likely scenario would have a like group of equipment being competitively procured periodically from different manufacturers resulting in different maintenance and spare parts requirements. [Ref. 23:pp. 34-41]

There is little more than intuitive data available to determine an exact breakdown of the seriousness and extent of APL proliferation. NAVSEALOGCEN has compiled a Standardization Benefits Analysis Report summarized below. The report is broken down by commodity class number (CC), CC name, the total number of unique APL's/equipment within each CC, the total of all equipments within the commodity class installed in the fleet, and the average yearly growth of APL's experienced within that CC over the past ten years. The data is current through 1986.

A review of the data below does not reveal anything in and of itself. The data in the list below are is a representative sample of the 89 CC's chosen at random. It serves

STANDARDIZATION BENEFITS ANALYSIS

CC	CC Name	Total APL's	Total Pop.	GROWTH/YEAR
01	PUMPS	7,400	118,070	364
02	BOILERS	198	1,525	8
13	TRANSFORMERS	878	102,412	9
15	CONTROLLERS	11,812	159,326	459
17	MOTORS	14,014	177,056	740
24	LIGHTING FIX.	1,035	1,404,922	24
26	PROJECTION EQUIP.	54	3,753	1
28	NAVIGATION EQUIP.	322	9,447	15
32	REFRIG. EQUIP.	3,407	62,866	255
33	AIR CONDITIONING	206	4,747	26
34	STARTERS	216	4,512	14
38	INDICATORS	2,192	98,042	127
43	GALLEY EQUIP.	2,142	30,416	146
50	PANELS	4,265	81,303	224
53	CAPSTANS	140	1,059	4
55	REELS	306	8,290	17
56	DAVITS	191	1,001	4
59	ELEVATORS	740	4,759	12
88	VALVES	59,254	4,118,680	1,968

to demonstrate how the entire data base can be misleading. For example, a cursory review would lead one to conclude that a far greater proliferation problem exists in the valve CC than in the galley equipment CC. This assumption can not be made on the above data alone. There may be far more functional differentiations for valve types than for galley equipment. It may be that a total of 2,142 APL's growing at an annual rate of 7% to accomplish a finite number of cooking and cleaning functions is a more serious proliferation problem than the 1,968 or 3% annual growth being experienced with the valve CC. Valves may have far more applications, functions, and uses than galley equipment and the annual APL growth of 1,968 may be the result of an

outstanding effort to standardize and eliminate proliferation in this area. It is beyond the scope of this report to resolve such an argument. The data is presented strictly to demonstrate that a proliferation problem would appear to exist.

Many of the CC's include items that perform similar functions but are significantly different in design, size, and shape to warrant a separate APL.

E. PROLIFERATION CAUSES

Corbett and Clarke in their theses, referenced throughout this chapter, attempt to pindown the contributing causes and the exact percentage of the problem each cause constitutes. Corbett attempted to form a regression equation that could explain the rate of proliferation in terms of the source of APL's. Corbett used the 44 commodity classes that showed an average annual growth that exceeded the aggregate average of the entire 89 commodity classes in at least four of the last five years starting in 1982. He then performed a regression analysis based on new ship deliveries. The regression equation was valid for only 14 of the 44 CC's analyzed. Though Corbett's regression equation was flawed, he developed a negative coefficient to describe a positive correlation [Ref. 23:p. 44], his work did support the idea that reasons for APL growth differed among and within commodity classes. Corbett was then able

to make the conclusion that APL growth could be attributed to the following factors:

- New ship deliveries.
- Shipyard introduction of new equipment through regular overhauls and ship restricted availabilities.
- Duplication; or like items being assigned separate APL's due to insufficient data or error.
- Competition.
- Field contracting officers procuring items outside the normal supply system.

This last cause is especially significant for as Corbett points out "it takes as little as thirty minutes to write a justification for using a piece part not in the DoD supply catalog." The Naval Audit Service finding cited by Corbett went on to say:

> ...our review indicated that selections were based primarily on engineering knowledge of specific commercial products that met the alteration or repair requirements, without considering the adaptability of existing standard equipment.

The Naval Audit Service has made the assumption that non-government standards exist and are acceptable for HM&E equipment. If these standards exist then they have described the perfect NDI item: an item acceptable for military use that is widespread available and built to industry accepted non-government standards that will assure parts support well into the future, non-obsolescence,and a relative security from product changes being incorporated in order to obtain a marketing edge. It is questionable as to whether or not "existing standards" even exist.

Other common sense reasons for proliferation also contribute to the problem of non-standardization. Such as:

- Technological improvements.
- Incorporating new contract standards or specifications based on lessons learned regarding safety or performance.
- Business closings of suppliers causing a unique design to become obsolete.

Even the FFG-7 and DD-963 class ships, the newest class ships for which historical data exist, have very disturbing standardization profiles. The FFG-7 class has:

- 3670 unique APL's.
- 387 APL's are installed aboard only one ship in the fleet.
- 555 APL's are installed aboard only one ship in the class.
- Over 40% of unique APL's are installed on half or less than half of the ships in the class.

Similarly, the DD-963 class has:

- 6809 unique APL's.
- 625 APL's are installed aboard only one ship in the fleet.
- 2365 or 34.73% of the APL's are installed aboard only one ship in the class.
- Over 55% of unique APL's are installed on half or less than half of the ships in the class.

Many activities contribute to the non-standardization figures. As Corbett and Clarke found, each activity in the contracting chain, from the organizational unit to the Inventory Manager at the ICP, is operating under a different set values, schedules, priorities and deadlines. The data

bases available today are not universally compatible enough to easily extract the source of new APL's. Generalizations have been developed and accepted when required. [Ref. 23:p. 42]

The problem of pinpointing the source of APL non-standardization is even more pronounced within the FFG-7 class ship, all of which have been in commission 12 years or less. The sources and real degree of design difference is unknown. It is also, currently, a statistic that could not be economically derived. [Ref. 12] Each ship is required to submit a form called a 4790CK when a new piece of equipment is installed or removed from it in order to upgrade its weapons system file at SPCC. The form has no requirement for the ship to list the source or reason for the change. Inferences could be made based on the ship's schedule at the time that the reported configuration change was submitted or possibly inferred from the write up on the form. Often the forms are illegible, incomprehensible, or submitted with no apparent relation to the date the actual equipment was installed or removed from the ship.

F. STANDARDIZATION PROGRAMS

There are many standardization programs and initiatives that are currently being implemented or designed throughout the Navy, including NAVSEA and SPCC. It appears that none of the programs may be widely enough applied and enforced to make a substantial difference in the amount of APL

proliferation and equipment non-standardization. This section addresses two programs that are being concurrently worked on by both NAVSEALOGCEN and SPCC.

In the section of this chapter on APL Costs, the cost of competition equation was presented. It represented the additional costs that SPCC incurred each time an additional piece of equipment was purchased that performed a function essentially the same as one already being performed by a Navy owned APL worthy piece of equipment. The equation is the basis of a standardization initiative called the Request For Proposal package. It is, as of January 1988, being developed into a contract clause that will be legally and competitively acceptable for inclusion in solicitations.

The program invokes the basic premises of OMB circular A-109 and requires a contractor to add ownership costs into his bid whenever an item is being competed for which APL's currently exist. The intended results of such a program is to reduce government costs, promote standardization, and maintain competition.

A second major initiative being promoted and incorporated by the Navy Supply Systems Command, NAVSEASYSCOM, NAVSEALOGCEN, and SPCC is the Standardization Candidate Selection Criteria (SCSC) Program.[2] The SCSC first identifies potential standardization candidates

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[2] A detailed description of the SCSC model is available in Mr. Richard Jones, NAVSEALOGCEN, Mechanicsburg, PA, Standardization Candidate Selection Criteria, undated.

utilizing the Standardization Benefits Analysis. For example, a report can be generated to list the APL's for all pumps that have the same characteristics; i.e.: pressure and capacity. If a significant number of APL groups with high numbers of APL's, low APL to manufacturer ratio, and a high influx level to the fleet in the recent past are found to exist then further investigation is done to determine whether or not the equipment is interchangeable or has the capacity to be combined under a like design. If a group of APL's meets this criteria, an economic analysis is performed to determine the potential savings, a design selection process is conducted to determine the optimum method for design standardization, and the results of the computations and determinations for all the APL groups are ranked based on the anticipated return on investment.

The net results of this plan is to reduce ownership costs by standardizing designs in the fleet. The premise is that the number of APL's will be reduced through the use of a standard design whose cost is offset over a five year amortization of acquisition and support costs. The standardization paybacks of this program with only 30 design projects initiated and 4 completed are:

- A total reduction of APL's of 638 (7% of the average annual APL increase).
- $73.4M in direct cost savings (original and projected acquisition savings).
- Projected ILS savings over a seven year cycle of $4.5M. [Ref. 1]

The four programs completed are for the 2 inch and under valve, the titanium fire pump, the P-250 portable fire pump, and shipboard air conditioners.

In the case of both these initiatives the projected impact on standardization may be greatly overstated. While each plan in theory will theoretically serve to reduce the number of APL's in the fleet, insufficient data exists to make a bold statement of savings regarding ILS savings. Without a firm understanding of the origin of new APL's as discussed previously and strict controls over future purchases by the other factors of proliferation ILS predictions are meaningless. The range of APL's currently in the fleet for any given equipment type will still require support throughout their active life. New APL's will continue to be installed in overhauls and urgent repair situations as past history seems to indicate. The proliferation is halted at SPCC through the use of standard designs and build to specification contracts and considerably slowed through the use of the Request for Proposal standardization program. Neither program will be successful as advertised until the other factors of proliferation are brought under control.

G. SUMMARY

Ownership costs and data design rights are vehicles for bringing APL proliferation under control. To date the

results of the effort extended in the above area would appear to be insignificant. In fact there is no evidence offered to indicate that growth has slowed at all or that the Navy can realistically hope to realize the results that it is predicting. It is an evidenced conclusion that HM&E equipment is NDI in nature and that past procurement of HM&E is tantamount to NDI procurement. It is contributing to a burgeoning rate of non-standardization and APL and parts proliferation. It would therefore appear that industry standards are inadequate to allow for standardization and a resultant decrease of Navy ownership costs for HM&E.

V. NON-GOVERNMENT STANDARDS

A. INTRODUCTION

One of the premises of the original NDI legislation is that the government/DoD relied too heavily on government specifications when non-government standards and specifications might exist to provide the same product or service at a greatly reduced acquisition price. HM&E procurements have been predominantly modified or ruggedized NDI and have resulted in an expensive proliferation problem.

This chapter will examine:

- The two basic types of standards.
- The causes of and reasons for non-government standards.
- The general procedures involved with creating a non-government/ASTM standard.
- The degree and effectiveness of the Navy's interaction with non-government standards organizations.
- The feasibility of adopting and creating non-government standards in lieu of renewing or creating government designs and standards.

This last question is particularly germane in light of a memo recently circulated throughout NAVSEA from the Assistant Secretary of Defense. The memo accompanies a proposed instruction that will institute a policy requiring DoD approval for any renewals of existing standards or the development of any new military specifications within 325 Federal Classes of materials. The Assistant Secretary

asserts that commercial specifications and standards exist in these classes and that the military has not fairly evaluated their suitability for use in government procurement. [Ref. 24] In order for the Navy to truly assess the validity and need of such a requirement, many of the questions that are discussed in this preliminary and necessarily cursory study of the ASTM F-25 Committee on Shipbuilding need to be addressed.

The results of this study appear to establish that the work currently being done by this committee will reduce HM&E proliferation, will not greatly reduce procurement costs, and will not enhance the military's ability to economically evaluate and procure in commercial markets. Industry participation on the boards appears to be limited. Their ability to generate standards is a tedious process that in the case of a complex standard may never come to fruition.

B. COMMERCIAL STANDARDIZATION

There are two general types of standardization. One type deals with standards of quality or performance and the other deals with standards for uniformity or design. There are many commercial examples of each. Screw threads, railroad track gauge, record sizes, and record speeds are examples of uniformity standards. These standards have been developed to allow for interchangeability and to promote practices consistent with economies of scale. [Ref. 25:p. 8] Quality standards have more to do with minimums and

maximums as they relate to identity, safety, and performance. Additionally:

> Quality standards are more likely to require "enforcement" than are standards for uniformity. Sellers generally have a great incentive to cheat, to pass off inferior products as superior. And buyers usually have more difficulty in judging quality than some dimensional uniformity needed for interchangeability. Compared to such simple quality characteristics as tensile strength or caloric content, physical dimensions generally are more readily apparent, easily and acceptably measurable, and dimensional interchangeability quickly determinable. [Ref. 25:p. 9]

This supports the premise that despite the generally accepted principles related to economies of scale, the voluntary industry adoption and development of non-government standards does not occur easily. Economic crisis, the threat of government regulation within an industry, and the possibility of increasing industry sales and profit margin are more likely to result in the institution of standards. For example, in the appliance industry quality standards were developed without government intervention but only after consumer choice issues and product debasement became an important issue on manufacturers sales and profit figures. [Ref. 26:pp. 52-53] Similarly, in the computer industry, IBM sabotaged or resisted every effort by the government and user groups to establish uniform standards that would either permit easy comparison with alternative products or assure compatibility with complementary hardware and software products. [Ref. 26:p. 91]

It would appear that competition and the desire to constantly increase the market share of a business are major forces working concurrently for and against the development of uniform standards. There is a potentially stratified market of consumers that can be targeted and catered to based on such qualities as net income, age, sex, etc. Other than where true economies of scale exist, it can be argued that there is little incentive or practicality in any company standardizing its product.

The development of non-government standards appears to be linked to an industry's user groups' ability to exercise a unified front in expressing their wants and desires. Only in exceptional circumstances can one expect sellers to arrive at common standards without sufficient input and direction from the users. As in the appliance industry, user generated standards or the government's intervention in imposing standards allows consumers to economically evaluate consumer goods at the time of purchase. In a manner, this forces industry to compete fairly for a consumer's dollar. In other words, it has been stated that industry's feeling toward voluntary self-regulation is:

> ...an industry may approve of government regulation when it limits fringe competition, particularly when the fringe may be reducing total industry demand. It will not voluntarily self-regulate when such regulation lowers profits and it sees its minimum accommodation as identical to the government's maximum demand. Its understanding of the government's maximum requirement may sometimes be confidently held on the basis of purchaser attitudes. It may under some circumstances support strong compulsory

legislation, if such legislation sanctions an exclusive broadening of the industry's product line. [Ref. 26:p. 72]

NDI initiatives and the current attempts by the government to influence the creation of non-government standards represents an attempt by a large user to make industry responsible to create public goods. A pure public good has two critical properties. The first is that it is not feasible to ration its use. The second is that it is not desirable to ration its use. [Ref. 27] National defense is an example of a pure public good which by its nature can not be equitably billed to those who receive a benefit from its existence. Therefore, it can be argued that products and standards that are primarily military in design and nature are also public goods. As will be discussed later in the chapter, this effort has been largely unsuccessful.

A further economic reason that inhibits the development of voluntary standards is the technological development rate within an industry. The short life of technology and the speed of innovation in many industries today make some proposed standards obsolete before they are adopted. The costs of generating the standards are incurred and the benefits that a standard provides are never realized. A review of the practices, procedures, and industry/user involvement in the ASTM F-25 Committee on Shipbuilding supports these suppositions and facts.

C. ASTM'S F-25 COMMITTEE ON SHIPBUILDING

ASTM has the stated scope of being a corporation that:

> ...is formed for the development of standards on characteristics and performance of materials, products, systems, and services; and the promotion of related knowledge. In ASTM terminology, standards include test methods, definitions, practices, classifications, and specifications. [Ref. 28:p. 1]

F-25 is a voluntary industry related committee sponsored by ASTM. The F-25 Committee is comprised of 263 total members, 109 of which have voting rights. The committee was founded in 1978. The members represent industry and the government/DoD/consumers. The Committee is further broken down into 10 sub-committees. Each deals with a specific major equipment area.

The sub-committees are:

Materials (F25.01)	Deck Machinery (F25.08)
Coatings (F25.02)	Electrical/Automation (F25.10)
Outfitting (F25.03)	Machinery (F25.11)
Hull Structures (F25.04)	Piping Systems (F25.13)
Gen'l Requirements (F25.07)	Insulation (F25.14)

The 1987 Annual Book of ASTM Standards, which is comprised of more than 60 bound volumes, contains 40 standards developed by the F-25 committee. Currently, that number has increased to 71; of these 71, only 14 have been adopted as acceptable for Navy use.[3] The bulk of the standards have been produced by the Piping Systems and Outfitting sub-committees. Navy adoption of an ASTM

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[3] Handout, ASTM-Committee-F-25-Standards, undated, Received from Mr. Howard Wildman, NAVSEA, March 1988 listing all current F-25 standards and the cognizant NAVSEA engineer.

standard does not signify that the standard will have carte blanche approval for any Naval acquisition or application. Its acceptability must be reviewed by a cognizant engineer prior to any use in order to preclude a misapplication of the standard. The cognizant engineer is the NAVSEA engineer responsible for reviewing, writing, and administrating a standard or specification.

Many other standards are being worked and reviewed by NAVSEA engineers for possible future adoption. The standards development process is long. Even when attempts are made to expedite the conversion process, the adoption process can take over nine months.

Grants and contracts from government agencies which are in accord with OMB Circular A-119, discussed earlier, have been made to accelerate this procedure. The U.S. Maritime Administration recently awarded a grant to the F-25 Committee for increased travel funding. The increased funding is for individuals to attend additional task group meetings in order to expedite standards development. [Ref. 29:p. 22] These efforts are laudable. Although, it appears that they will not have a significant impact on expediting the consensus procedures that are required to occur between all the users and manufacturers; each trying to protect there own individual perspectives and biases. Also, the fact that such contributions are being made is an indictment of the Committee's ability and industry's resolve to create

standards to replace items that have essentially been public products.

In accordance with the intent of OMB Circular A-119, there is considerable effort being put forward to incorporate more non-government standards in the procurement process. However, this is not an easy process. Standards must be written in ASTM format. A proposed standard must then be approved by the NAVSEA cognizant design engineer's chain of command prior to being submitted to a sub-committee task group. The standard generation process to here is little different than the process involved with creating an ordinary military standard. The military must still write the standard or contract for it to be written. Only now, upon completion of the generation of the proposed standard, it must pass through an extremely slow ASTM adoption process. This is one of the reasons why the government has a natural aversion to the adoption and creation of non-government standards. To understand this aversion one must first understand a little about the difficulties encountered in the ASTM adoption process.

In general the adoption process can be summarized as follows:

- Originating group submits a proposed standard to the cognizant sub-committee.
- A ballot with the proposal is mailed to the voting members. They are directed to respond in a limited amount of time but not less than 30 days.

- A two-thirds majority of affirmative votes must be received prior to any further action being taken.

- Negative voters submit an explanation with their vote delineating their objections to the proposed standards.

- All negative voters must be notified of receipt of their vote and the explanation considered by the sub-committee.

- If the reason for the negative vote is found to be persuasive then the proposed standard is withdrawn and returned to the originating group.

- If the reason for the negative vote is not considered persuasive and the two-thirds approval of the proposal was achieved then the proposed standard is sent up to the main committee. A list of all the negative votes along with the reason and corresponding sub-committee's comments as to why the negative vote was not found to be persuasive accompanies the proposal.

Similar procedures are then initiated at both the main committee and a society level before submission to the Committee on Standards for final publication determination. At any step a proposed standard can be sent back to the task group or sub-committee for revision or clarification. Due to the fact that the F-25 Committee formally meets only twice a year, each setback almost certainly results in an additional six month delay in publishing the standard. It can be seen how these procedures can easily extend the formal process over an exceedingly long period of time. The above actions are required not only for approvals but also for revisions, reapprovals, and withdrawals. Some standards proposals have been in the approval process since the inception of the ASTM F-25 Committee in 1978. [Ref. 30]

The bottom line is that the approval process is very cumbersome. Also, after adoption the threat exists that a standard adopted by the Navy could be significantly changed or deleted in a sub-committee review or reapproval process. The assignment of a NAVSEA cognizant engineer is meant to preclude this circumstance. No one member can control the actions of the committee. Therefore, in an extreme circumstance a non-government standard could be superseded or allowed to lapse and no military specification or Navy standard drawing would exist to take its place.

In order to alleviate these and other fears ASTM's F25-94, Administrative Sub-committee on Navy Documents Conversion created the Handbook to Assist in the Navy Document Conversion Program. This allows the Navy to convert current military standards to an ASTM standard, maintain the NAVSEA cognizant engineer as responsible for any Navy application or use, but pass the prime responsibility for content and accuracy of the standard to ASTM. The program, though relatively new appears destined to meet with very limited success. There is a supposition that industry is interested in developing standards acceptable to the government. That proposition appears to be false. Government standards written to accommodate those military requirements that are significantly different than commercial requirements are equivalent to public goods. A review of ASTM's performance in the next section indicates

that industry is unwilling to subsidize the care and maintenance of converted government standards.

D. ASTM'S PERFORMANCE

As has been stated previously, the F-25 Committee's ability to add new standards at the rate that the government is considering is highly questionable. Industry's resolve in seeing such a program through is suspect. There can hardly be any incentive on their part to provide people to voluntary standards boards to predominantly review and update converted military standards. In general, based on the slow influx of new standards other than those initiated by the government there is no apparent compelling need on industry's part to create any new standards at all. The government, while a large consumer, rarely constitutes enough of the overall market share to influence industry participation in the development of standards. There is also the possibility that if one firm does get involved in generating a much needed government standard requirement that the Navy would be prohibited from using it due to the unfair competitive situation that it may represent. Therefore, the simple addition of new ASTM standards may not equate to an industry wide or government acceptance and adoption. It is extremely naive to assume that acquisition price savings will be achieved by using a non-government standard if the standard is applied to a product produced strictly for government use.

A massive influx of government standards into the purview of the F-25 Committee would greatly overload its volunteer participants. For example, there are 20 members of the F-25 Sub-Committee on Hull Structure. Three are military, one is the ASTM Staff Manager, and the others are non-military volunteers. Since this is a voluntary organization, it is uncertain as to whether or not these individuals or agencies have either the time, inclination or resources to expand their subcommittees cognizance over any new Navy conversion specifications.

In order to determine the extent to which a voluntary non-government standards group was willing and able to generate and maintain meaningful government standards, representative chairman of the sub-committees were contacted and asked the following questions:

- How long have you been on the committee?
- What percent of your time is spent on committee work?
- How often does your committee meet and what are the attendance percentages?
- Where do the standardization proposals originate from?
- What is the average processing time from the time a standard proposal is submitted until it is published?
- What is the backlog of standard proposals for your sub-committee?
- What is the interest among the industry members of your sub-committee in developing or converting Navy standards into ASTM standards and what kind of data does the Navy make available to a contractor to accomplish this?

(i.e.: failure, usage, inventory proliferation cost, range of spare parts support problems)

- How do you assess the performance of your committee?

The results of the interviews were very similar. Sub-committee Chairmen have been members of ASTM from three to ten years. The average amount of time that these individuals spend on ASTM work related matters is from one to two months a year. All the sub-committees meet twice a year concurrent with the F-25 Main Committee meeting. Task groups creating certain standards may meet more often and some sub-committees meet independently as many as four times per year. Sub-committee member attendance ranged between 30% to 60%. Standard proposals were perceived to originate evenly between user and industry groups. The average time required to get a standard accepted and published depends on the complexity of the item. But all the chairman agreed that three years appeared to be the norm for a standard that is not too complex. A nine month acceptance time can be achieved in unusual situations. With a maximum amount of personal interest one simple standard was passed in four months. [Ref. 31]

The most revealing responses were received regarding the question concerning industry's interest in developing or converting Navy standards into non-government standards. The responses indicated there may be some animosity or lack of confidence in the ability of the commercial and Navy interests to successfully work together. The frustration

voiced from the commercial representatives regarding working with the Navy included:

- They are inflexible in their demands.
- Some of the NAVSEA engineers have been in place for 25 to 30 years. They are comfortable with military standards and military specifications and are resistant to any change.
- There is no one person or committee in charge of conversion to ASTM.
- At each semi-annual meeting the Navy sends a different representative. There is no continuity. Therefore, when an item comes up for vote the Navy representative often casts a negative vote throwing the standard back to the task group and adding at least another six months to the acceptance process and the convening of the next sub-committee meeting. This is an even more exasperating problem in that the protest is often over an item that was resolved with their predecessor representative many months prior.
- NAVSEA representatives often do not have the final say. When determinations or conflicts have to be resolved, we first have to cut our way through a bureaucracy of civilian engineers only to then be confronted by the military hierarchy before a matter can be resolved.
- Non-government standards are viewed as a threat to their livelihood.

It is not surprising that the viewpoint regarding the Navy's perception of the same initiatives was nearly opposite. NAVSEA representatives to the voluntary industry standards bodies cite such distractions as:

- Certain company's are trying to add items to a standard that would result in them achieving an unnecessary advantage in a contract bid for the item.
- Companies are unwilling to recognize the unique requirements that are inherent to a Naval shipboard environment.

- Supervisors, though publicly voicing support for a shift toward non-government standards, are often against writing standards in ASTM format.

Throughout all the interviews the undercurrent of feeling was that non-government standards could work but that there must be more cooperation. The prevailing feeling appeared to be that the push to develop shipbuilding standards started many years too late. The Navy's need to develop Military Standards and Specifications was primarily caused by a lack of any alternative standards to use or any standards bodies that were staffed with members sensitive to Navy or ruggedized standards necessary in a military environment.

E. IMPLICATIONS

Many standards bodies and organizations exist whose standards could be effectively applied to some of the Navy's procurement needs. In many cases these standards could be used to identify items that are acceptable HM&E NDI materials. There is work being done in trying to develop new standards through voluntary organizations other than ASTM. However, there is little interaction between industry and Navy to identify further potential candidates for Navy acceptance. This situation is not likely to change. The Navy in most instances is too nominal a buyer to warrant industry embracing a unified standards programs. One of the industry representatives interviewed revealed that his company only partially relied on the ASTM standards in its

own procurement process. Procurements within his company were modified by individualized standards in much the same fashion as the Navy.

It is therefore not surprising that industry seldom approaches the Navy volunteering to develop a standard for a unique usage requirement. Yet when they do, the Navy appears to rarely supply them with more than specification data and review assistance. Other information that would provide a company with incentive and reasons why a new design or standard would be beneficial to both the Navy and the company such as Annual Buy Figures are not provided to the company. When the Navy decides that a new standard or specification is required, they do not go before the cognizant committees and sub-committees with the applicable data such as maintenance downtime, equipment mission requirements, and other historically developed data such as exact form, fit, and function requirements that could persuade industry members to invest their time in the creation of the pertinent standard.

A recent example cited during the interview process of the research for this paper was a fleet generated requirement for a "jaws of life" lifesaving device. In this case the Navy refused to accept the standard for these items that was already being used profusely in the non-military sector. Instead the cognizant powers at NAVSEA decided to design a gold-plated government standard that would result

in an instrument that would do more than its civilian counterpart. The result is that the device has not yet been officially procured. The standard is not completed and no acquisition cost estimate exists. However, fleet units have probably already utilized their own purchasing authority to obtain commercial versions of the lifesaving item.

F. CONCLUSIONS

The non-government sector is an ideal place to encourage the implementation of standards. The lengthy procedures that non-government standards boards require to accept and adopt a standard make it unlikely that a large number of government standards can be converted in any reasonable period of time. These groups are voluntary and would not be able to physically implement and review the volume of standards and specifications that is involved with a massive Navy conversion effort. Additionally, the demonstrated turnover rate of membership representatives since the Committee's inception in 1978 of 80% to 95% will result in a lot of wasted effort and startover requirements.

The Assistant Secretary of Defense's directive mandating usage of commercial specifications in 325 federal classes of material appears to be unrealistic. Many commercial specifications are not suitable for military purposes. A massive production of paper work in preparing justifications to deviate from this directive is the obvious fallout of such a policy. However, the Secretary did recognize that

drastic action appears to be necessary to cause the services to seriously evaluate options to generating new standards when an equipment need is identified.

ASTM is one of the few voluntary standards organizations, with which NAVSEA has developed such a wide degree of representation. It is unrealistic to believe that NAVSEA has the manpower to fairly represent and voice the Navy's concerns before all the non-government standards bodies that exist. Yet the adoption of non-government standards is clearly a form of NDI behavior that has the potential of generating savings if properly administrated.

A more controlled conversion from government to non-government standards would seem to be warranted. By taking the best aspects of the Navy standardization programs, NAVSEA could identify candidates for conversion from government to non-government standards. Candidates could be identified using equipment uses and traits that indicate savings could be achieved if a non-government standard existed. The list could be prioritized based on the similarity between the military and commercial requirements and estimated savings projected from available historical ownership and acquisition cost data. This process that would closely resemble the Standardization Candidate Selection Criteria currently being employed at NAVSEALOGCEN would allow NAVSEA engineers to concentrate their conversion efforts on equipments where significant dollar benefits

could be achieved. It could be the work of future research or theses to develop a formula that could identify the traits and information that could be applied to classes and types of equipment to forecast dollar savings that could be achieved by pursuing such a goal.

VI. CONCLUSIONS

A. INTRODUCTION

In Chapter I, two goals were proposed for this thesis. They were to investigate: 1) The effect of NDI legislation on the efforts to curb APL proliferation in the purchases of HM&E related items, and 2) Whether or not voluntary non-government standards and boards are an effective force by which to incorporate the Navy's specific needs and requirements into standards. In order to answer these concerns eight subsidiary questions were addressed in the previous four chapters. Each chapter summarized its findings and made conclusions relevant to the area discussed. This section is a brief review of these findings with an emphasis on the overall implications of the previous conclusions on the above two goals.

B. REVIEW

The following findings have been supported in previous chapters and are listed below for qualification and review:

1. NDI legislation will have little impact on the proliferation problem unless it is interpreted in a way that precludes the further development and implementation of NAVSEALOGCEN standardization programs such as the Standardization Candidate Selection Criteria (SCSC) and the Request For Proposal (RFP) initiatives.

2. Current HM&E purchases appear to be predominantly NDI in nature with ruggedization often taking place where necessary.

3. Firms' product differentiation, avoidance of industry standards, and reliance upon company standards have resulted in indeterminably large amounts of additional HM&E ownership ship costs.

4. Proposed DoD regulations regarding restrictions on the development of new Navy specifications are unrealistic due to the interests represented by the non-government standards bodies, the size of the bodies, and the inability of the Navy to fairly represent itself on all these bodies with the limited number of personnel available.

5. Non-government standards are not always adopted when feasible and the reasons appear to be highly subjective in at least some instances.

6. The procedures involved in developing a non-government standard of any significance are long and uncertain. A single objecting member with a valid objection can prohibit a standard from ever being forwarded for Society acceptance.

7. NAVSEA representatives are familiar with government standards which may be a contributing factor toward the perceived reluctance to implement industry standards. Increased control of the end product is often deemed essential despite the initial cost increase.

The Navy is just now beginning to realize the magnitude of its standardization problem. Ownership costs are being calculated. While these calculations are loosely computed figures based on subjective assignments of values, they represent unquestionably large capital outlays. The savings projected in such programs as the SCSC and RFP appear insignificant when compared to the total SPCC outlays in 1984 of $1.75 billion. Yet, the savings are significant enough to provide the annual monetary requirements for a small battle group.

The availability of many equipment models that can perform to certain standards has contributed to the proliferation problem. Acceptance of non-government standards and an increased reliance on NDI may reduce the acquisition price but not without dramatically increasing equipment life-cycle costs.

Unfortunately, the Navy has not sufficiently identified the sources of the proliferation problem. They have developed programs at different levels of the procurement system that will slow the problem but not stem it. In order to be able to make realistic projections of savings that can be realized by implementing a standardization program, one must be reasonably confident that solution will stop further proliferation.

The major problems that have developed from NDI purchases as discussed in this paper are from those purchases initiated below or above the SPCC level. Program managers must make tradeoff decisions when bringing a product on line and often deployment takes precedence over ILS considerations. These decisions are made knowing that part support problems will develop in the future. Purchases are made by type commanders with little consideration given to ownership costs as they are unaware or perhaps uncaring of the future problems that may result in providing support and replacement for such systems. The contribution to

proliferation from overhaul and maintenance activities is also not clearly understood.

Corrective action cannot be taken without carefully evaluating the impact that a resulting policy decision could have on continued proliferation and increased life-cycle costs. Congress' law ordering a preference for NDI material and the Assistant Secretary of Defense's directive to use non-government standards in 325 Federal Classes of materials may be the types of shotgun kneejerk reactions that increase total acquisition costs rather than decreasing them. It is clear that the Navy has not adopted non-government standards wherever possible. Yet, in general, it appears that non-government standards are not easily made to incorporate applications that could be defined as solely military. Their use must be carefully monitored with eyes toward the many problems that can result in terms of quality, reliability, maintainability, and supportability. These considerations are inter-related and become more pronounced in a shipboard environment where contract support is not always available.

C. SUMMARY OF FINDINGS AND RECOMMENDATIONS

Costs and benefits are not easily definable or assignable in any of the problems investigated in this report. It is important that people understand and evaluate the effects of a decision to purchase an NDI item or adopt a commercial standard. The effects that NDI decisions have on

projected ownership costs and equipment and parts proliferation can be projected and assessed.

Historical data justifies restricting or precluding the introduction to the fleet of new equipment that is configured differently but performs similar functions as existing equipment. The evidence suggests that the additional ownership costs incurred by such procedures are prohibitive. Yet, procurement practices to date have allowed this proliferation to continue. Innovative procurement methods must be developed and utilized in areas where it has been identified that increased use of NDI and inadequate government standards equates to high life-cycle costs. The two inch valve program and other successful examples exist to prove that substantial savings can be generated by having the Navy create its own rigid design and performance specifications and standards.

It remains to be seen whether or not the Navy/military standards can be converted to non-government standards that will generate additional savings. One conclusion that is quite apparent from the limited interviews conducted regarding government use of and conversion to non-government standards is that it appears to be infeasible on any grand scale. Voluntary standards groups are too underfunded, understaffed, and uninterested in developing standards for items predominantly considered to be for use strictly by the military. That does not mean to imply that the Navy should

not use non-government standards where they are available and suitable for the projected use of the equipment being procured. In fact, the overriding premise of this thesis has been that no one rule can apply to all purchases.

A general lack of communications appears to exist between all the different agencies involved with NDI policy, specification control, and proliferation control/ standardization. Attempts to control proliferation are directly opposed to plans to incorporate greater NDI purchases and a higher volume of non-government standards.

Non-government standards and NDI can offer time and dollar savings and conveniences over other product development and procurement practices. But a coordinated attack should be formulated utilizing the standardization tools in consonance with the available industry goods and standards. Determinations could be made to adopt non-government standards that met criteria that assured their long term suitability to the service's needs. The government could then give priority to developing non-government standards, with industry assisting, for items that:

- historical data has proven that standardization is becoming essential.
- projected savings can be predicted to be the most substantial.

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